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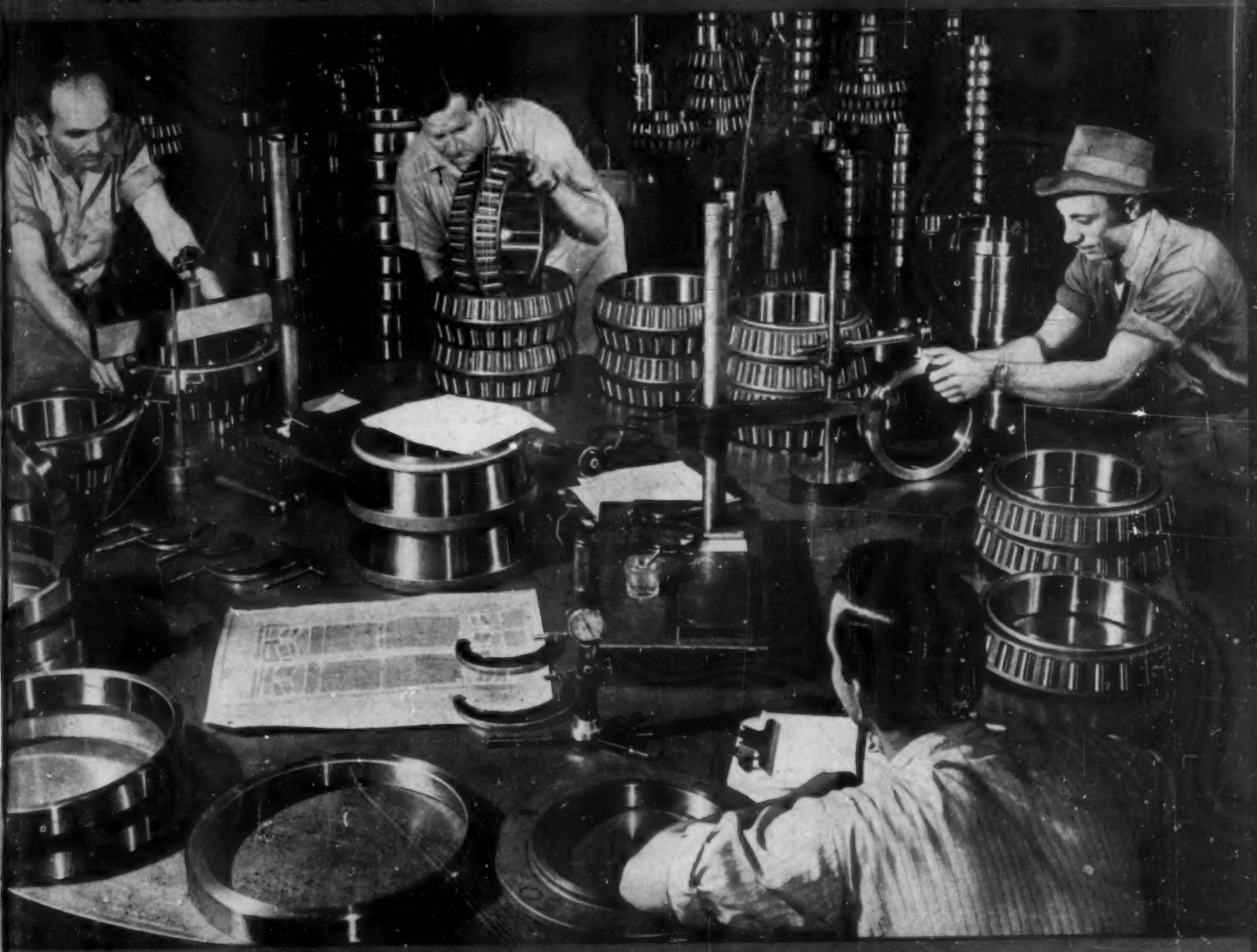
SCIENCE NEWS LETTER

VOL. 50, NO. 24

THE WEEKLY SUMMARY OF CURRENT SCIENCE • DECEMBER 14, 1946



Working For Less Friction

See Page 378

A SCIENCE SERVICE PUBLICATION

1921 TWENTY-FIFTH ANNIVERSARY 1946

RADIO FREQUENCY HEATING

gives you heat where you want it... as you want it

For many years, man has used *external heat* to harden, braze, solder, or anneal metals—to condition or otherwise treat such substances as rubber, textile fibers and the gluing of wood.

Now, through Electronic Radio Frequency Heating, science has achieved the modern miracle of *heating* without *heat!*

The outstanding feature of *Induction Heating* of metallic substances...and *Dielectric Heating* of nonmetallic substances...is the generation of heat *within the material itself* and at temperatures higher than ever before obtainable. Frequencies used range from 200 kilocycles to 50 megacycles.

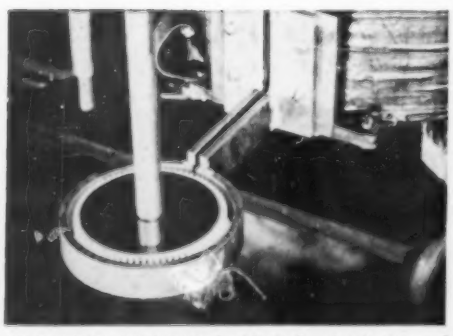
Induction and dielectric heating have accomplished wonders in reducing production time and cost...controlling the rate and range of heating...improving quality and appearance of the product.

If you are interested in using this new production tool in your business, send for booklet B-3620—or arrange for a showing of our new sound motion picture in full color: "Radio Frequency Heating."

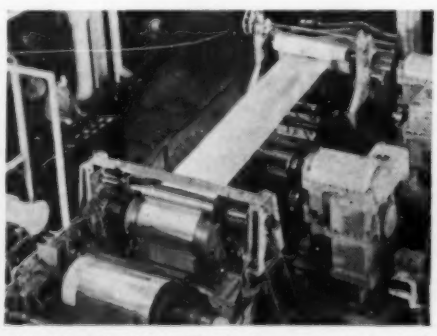
Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Tune in: TED MALONE—Monday, Wednesday, Friday, 11:45 A.M. EST, American Netwo



INDUCTION HEATING is ideal for hardening of gears (see above), contour hardening, brazing, soft soldering and annealing.



DURING THE WAR Westinghouse research engineers pioneered induction heating equipment for *reflowing tin* on electrolytic tin plate. Result *one* pound of tin now does the work of *three.*

DIELECTRIC HEATING has many advantages over conventional heating in bonding plywood (see above), molding plastic preforms, textile processing—and curing plastic laminates rubber, etc.

MEDICINE

Atom Defense-3,000 MDs

Only a few men and women are prepared to give medical defense against the dropping of atom bombs. Army and Navy may give them special training.

➤ A THIN LINE of at most 3,000 men constitutes our first line of medical defense against atom bombs if any nation uses them against us. These 3,000 are the men and women physicians in the United States specializing in X-ray and radium work.

They are the ones who will be responsible for determining which buildings, which food, water and milk supplies and even where the air is safe from deadly doses of radioactivity dispersed by a bomb explosion.

Those of them attending the meeting of the Radiological Society of North America in Chicago were told by Dr. Stafford Warren of the University of Rochester, formerly of the Manhattan Project medical division, that next spring or summer they will hear from the Army and Navy of plans to give them special training for the job they will have in the next war, if one comes.

Radioactivity equivalent to that from several thousand pounds of radium was released by the underwater explosion at Bikini, Dr. Warren reported. He was not allowed to reveal the exact amount as that is still a military secret.

The approximate figures were frightening enough to the radiologists accustomed to using utmost care in handling radium in microgram amounts. Micrograms are millionths of a gram, a gram itself being about one-thirtieth of an ounce.

Contamination with deadly radioactivity was not a problem in the case of the bombs dropped over Japan because the deadly fission products rapidly rose to the stratosphere. Following the underwater explosion at Bikini, a black rain of radioactive material fell, and a mist of the same deadly stuff was carried for miles by the wind.

Explosion of a few atom bombs under the water of any of the Great Lakes would make uninhabitable not only Chicago, Cleveland, Buffalo and other lake cities but others miles away. All inhabitants of the cities who escaped immediate death would suffer the fate of the radium watch dial workers in the last war who died of cancer from the minute amounts of radium that got into their bones.

Detecting material contaminated with radioactivity is only one part of the vast job facing our medical defense workers, Dr. Warren pointed out. Once the material is detected, a safe way of disposing of it must be found. It cannot be dumped into the sewers because that would endanger people many miles away whose water supply comes from the rivers into which the sewers drain. And there will be tons and tons of such deadly material to dispose of if an atom bomb or two are exploded under water near only one of our harbor cities.

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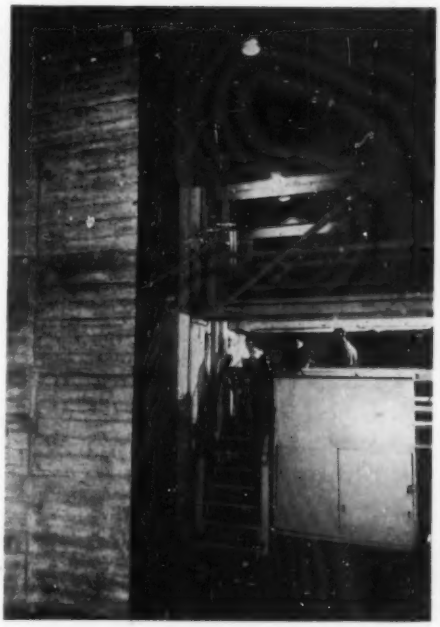

***ATOMIC PILE**—Operators place a sample for irradiation on a stringer which will be pushed into the chain reacting pile at the Argonne National Laboratory.*

MEDICINE

X-Rays Endanger Women

➤ WOMEN NEED greater protection than men from radiation, whether they are atomic energy workers, or nurses and technicians helping give radium and X-ray treatments, or girls in candy factories using X-rays to check candy boxes.

Warning to this effect was given by Dr. Egon Lorenz, National Cancer Institute biophysicist, at the meeting of the Radiological Society of North America.

His warning was based on studies with mice, made to aid in health protection of workers in atomic bomb production.

Cancer of the ovaries is the hazard faced by women working with penetrating radiations in atomic energy production or in X-ray laboratories. If their ovaries react to radiation in the same way mouse ovaries do, the working time of the women with such radiations should be reduced for a few years or the permissible dose should be decreased, Dr. Lorenz stated.

The "permissible dose" of radiation now considered safe for workers is one-tenth Roentgen per eight-hour working day.

A shortening of the life span which Dr. Lorenz termed "unimportant" might "perhaps" result from this dosage, the mice studies showed. Such a dose, however, even over long periods of time, will not have cancer-causing effects except in the case of women.

Damage to the future children of persons exposed to this dosage probably will not occur. Dr. Lorenz said the present permissible dose gives a sufficiently wide margin of safety that "visible mutations will not occur."

No visible mutations indicating damage from the radiation appeared in breeding experiments and continuous breeding of mice up to six generations under exposure. About 12,000 mice were used in this experiment.

A possible unknown factor in connection with slow neutrons that might injure atomic bomb workers was suspected during the early days of the Manhattan Project. This worry to the medical scientists responsible for health protection turned out to be unfounded, Dr. Raymond E. Zirkle of the University of Chicago reported. Practically all the damage that slow neutrons could do can be accounted for in terms of physical and biological events already known before

work on the atom bomb started and against which the workers were protected.

"Present or prospective workers in the new field of atomic energy should be caused no anxiety," Dr. Paul S. Henshaw, of the Clinton laboratories, declared reassuringly.

The exposure to radiations required to induce cancer in animals, he reported, is far above the permissible levels allowed Manhattan Project workers.

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MEDICINE

Uranium Toxic to Body

➤ URANIUM poisoning of the kidney is a hazard facing atomic power workers unless suitable precautions are taken.

The chemical toxicity of uranium is a greater danger than the radiation hazard of the element itself before fission. The public has heard little of this chemical hazard but it was given full attention by the group protecting the health of the atom bomb workers, Dr. Andrew H. Dowdy, radiology professor and Manhattan department director at the University of Rochester, reports.

One of their first problems was to devise a reliable method for detecting uranium in very small quantities. One part of uranium in 10,000,000 parts of animal tissue, blood or urine can be accurately measured by the method they developed, Prof. Dowdy reported to the American Public Health Association. Its presence can be detected in such small amounts as 1/2,000,000,000 of a gram. A gram is about a thirtieth of an ounce.

The poisonousness of uranium varies to a certain degree, though not entirely, with the solubility of the compounds. These may be found in the form of dusts or gases.

Many of the uranium compounds may be absorbed into the body through the skin, by way of the lungs or from the stomach and intestines by being swallowed.

Protection against uranium poisoning consists in completely closed systems, adequate ventilation systems to evacuate harmful agents from the atmosphere, gas masks, and special procedures for laundering the work clothing of plant personnel.

Personal hygiene and rigid medical supervision to detect small amounts of harmful substances in the excreta of personnel are important for health protection.

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PLANT PATHOLOGY

Fungus Ate 1946 Tomatoes

➤ THE SAME DEADLY fungus that caused famine in Ireland a hundred years ago by wiping out the potato crop will make canned tomatoes and tomato juice harder to find this winter at your grocery store.

An unexpected attack of the late blight of tomato sneaked up on American tomato fields this year just as they were about to produce a bumper crop of red fruits for canning and juice. It caused losses as high as nine-tenths of the potential yield in some commercial fields, and diminished the returns by half or more in eight eastern seaboard states. This is another strain of the death-dealing blight that visited Ireland a century ago.

A United States Department of Agriculture survey of the lost battle against the tomato late blight this year shows that the heaviest damage was concentrated in the chain of states along the Atlantic Coast from Virginia to Florida, together with Pennsylvania, Delaware and Rhode Island. In these states, more than half the potential crop was lost.

The deadly fungus, *Phytophthora infestans,* has damaged potatoes in this country as well as causing the common late blight and tuber rot in Irish potatoes. But where it attacks potatoes, it frequently does little or no damage to neighboring tomatoes. It takes seven successive generations of the potato menace for it to develop into the tomato late blight.

A generation requires a minimum of three days from the time the potato late blight has infected the tomato leaf or fruit, a lesion has been formed and spores have been produced. Favorable weather, cool wet nights and warm days, for 21 successive days are necessary for the blight to become the tomato-attacking strain.

One reason for the wholesale losses in this year's tomato crop was lack of equipment for spraying and dusting the fields with fungicides. As a desperate resort, airplane dusting was tried on a number of fields, but little success was reported.

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Brazil is forging ahead in *rice* production; its 1946 crop, harvested from March to May, is about 115,000,000 bushels, against 103,000,000 bushels the previous year and far more than in prewar years.

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GENERAL SCIENCE

Noted German Scientists Work for Uncle Sam

➤ IN ADDITION to the 270 German and Austrian technical experts recently revealed to be working in this country under the War Department, more are known to be in Navy custody, but their number and the nature of their work has not been released.

Army plans call for increasing the number to approximately 1,000, in the program which got underway on an experimental basis in September, 1945. Some of these alien scientists have been granted the right to apply for immigration visas and may eventually become American citizens.

Included among the "big name" scientists revealed to be in this country are Dr. Alexander W. Lippisch, former chief designer of the Messerschmidt Aircraft Co.; Wernher von Braun, credited with inventing the V-2 rocket; Dr. Friedrich Doblhoff, Vienna, designer of the world's first jet-propelled helicopter; and Dr. Helmuth Heinrich, formerly of the Graf Zeppelin Research Institute. German rocket experts are working at Fort Bliss, Tex., and nearby White Sands, N. Mex., where U. S. Army Ordnance is firing V-2's to gather scientific data. Another group of the Germans is stationed at Wright Field, Ohio, where the Army Air Forces have a large research and development center.

Many of the scientists brought publications and notes which may prove important contributions to American science and industry, the Army said.

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ZOOLOGY

Oscar Made His Fortune; Estate Finally Killed Him

➤ OSCAR, pet seal of the California Academy of Sciences, used to dive for pennies. Having no pockets in his sealskin coat, he swallowed them. That was where he made his fatal mistake.

One morning he was found dead on the floor of his pool. Autopsy disclosed that he had nearly four pounds of coins in his stomach, mostly pennies. These included a good many of the wartime "white pennies" which contained zinc, suspected of being poisonous.

Cash value of Oscar's "estate" was $7.54. It was donated to the San Francisco Children's Hospital.

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***WORKING FOR U. S.**—A German scientist, Dr. Helmuth Heinrich, demonstrates an unconventional type parachute in the vertical wind tunnel at Wright Field, Ohio. U. S. Army Air Forces photo.*

PHYSIOLOGY

Growth Fluid Synthesized

Chick embryo tissue cultures live in first solutions of known chemical composition. Research may lead to knowledge of tissue differences.

➤ FRAGMENTS of embryo chick heart tissue have been kept alive and pulsing for as much as six weeks in a solution of exactly known chemical composition, Dr. Philip R. White of the Institute for Cancer Research, Philadelphia, announced in a lecture before the New York Academy of Sciences. Other embryo tissues have been maintained in growing condition for somewhat longer periods.

This represents the first step towards growing animal tissues indefinitely under fully known and controllable conditions, something that has already been accomplished on plant tissues by Dr. White and several other workers.

The "immortal" chick heart cultures, with which the name of the late Dr. Alexis Carrel has been popularly associated, were grown in fluids taken from animal bodies. Since the makeup of these fluids is very imperfectly known, important details of the biochemistry of growth must also remain unknown.

It is the determination of Dr. White and his co-workers to duplicate with animal tissues the success they have already had in plant tissues, thereby opening the road toward better knowledge of all growth processes, including the malignant ones that produce cancers.

The nutrient solution used in Dr. White's laboratories contains dextrose, several mineral salts, 11 vitamins and 12 amino acids. He stated candidly that "this is a shotgun mixture which will have to be studied in more detail, which can probably be simplified, and may ultimately need to be enlarged."

One of the things that should be possible, once a really successful animal tissue culture fluid has been developed, capable of sustaining life and growth indefinitely, is a study of the basic biochemical differences between normal and cancerous tissue.

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PINE CLUSTER—Each pine cone is normal except for its miniature size.

BOTANY

Clump of Cones Found on Pine Tree

➤ MASS OF 208 pine cones, each bearing seed and normal in every way, except for their miniature size, was found growing on a tree in the vicinity of Plymouth, Mass. Each of the six branches that make up the second whorl from the top of the pitch pine tree was completely clothed with cones for a length of six inches or more. Picture by Edwin F. Steffek of the Massachusetts Horticultural Society.

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INVENTION

African Inventor Offers Solution to Parking Problem

➤ AFRICA CAN'T BE as vast a continent as the traveloguers used to tell us; it seems to have developed a parking problem. At any rate, a South African inventor, Martin Rickland of Durban, Natal, comes up with a new kind of parking building, on which he has just received U. S. patent 2,412,009.

Cars as they enter are put on platforms like huge trays. These are carried up to any desired level on an elevator. Then they are slid off onto their designated floors, as trays of crockery might be put on shelves. Double sets of rollers underneath facilitate the sliding job.

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OPTICS

Equipment Extends Vision

➤ A NEW MICROSCOPE that extends the range of human vision and is particularly useful in the study of transparent tissues is being made available by the American Optical Company's Scientific Instrument Division.

A special plate introduced into the objective lens system brings out details otherwise unseen by making the specimen lighter or darker than its surroundings. Transparent living organisms can thus be studied without staining with dyes, a procedure that kills most organisms.

Many significant experiments can now be made in biology and the effects fully studied with the new instrument. Tiny chambers, for example, can be constructed on microscope slides to imprison living organisms. These chambers can be utilized to supply nutrients and oxygen, and to remove toxic excretions. Thus the effect on the organisms of many agents, including drugs and vitamins, can be investigated.

Crystals, otherwise barely visible, can be seen with the phase microscope. Regions within certain substances can be made invisible, facilitating the discovery of impurities.

A diaphragm for controlling light concentrated on a specimen and one of the new diffraction plates placed in the objective lens system transform a standard light microscope into a phase microscope. An auxiliary telescope used in place of the microscope eyepiece helps center the equipment.

The specimen is first illuminated by a hollow cone of light and a diffraction plate inserted within the microscope objective. Depending on the kind of diffraction plate, any regions within the specimen of different optical path can be made bright on a dark background, or dark on a light background. The invisible phase differences of the light passing through a transparent specimen are converted into differences in light intensity to which the eye is sensitive.

The equipment will be made available for several models of the company's Spencer microscopes. During the last few years a few lucky scientists had their microscopes adapted for study of specific specimens. Different types of the newly-developed diffraction plates were found preferable for various kinds of investigations.

Research conducted by A. H. Bennett, research director of the division, Drs. Harold Osterberg, Helen Jupnik and Oscar W. Richards have made possible the manufacture of phase microscopes in this country. Microscopes of this type were first described about a decade ago by the Dutch scientist F. Zernike. Two phase microscopes were brought back as scientific booty of war from Jena, Germany. They were developed independently by scientists of the Zeiss Optical Works. (*See SNL*, June 22, 1946.)

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MEDICINE

Eye-Bank Aids Seeing

➤ HUNDREDS OF PERSONS are now wearing living eyes that do not belong to them by birth. Altogether probably some 1,500 persons have had this experience since the first corneal transplant or eye grafting operation was performed about 100 years ago, Dr. Herbert Katzin, head of the Eye-Bank's laboratory in New York, estimates.

In order to give more persons this chance to see through eye tissues from other eyes when their own fail, the Eye-Bank is giving training, through fellowships, to eye surgeons from other parts of the country, Dr. Katzin reported to the National Society for the Prevention of Blindness meeting.

They perfect their skill through operating on rabbits' eyes. This is even more difficult than operating on human eyes, for one thing because the rabbit's cornea is thinner and tears more easily than human corneas. The bunnies will not lie quietly in bed after the operation, which leads to complications more often than in human corneal grafting operations.

Methods of preserving eyes until they can be used, the usefulness of eyes removed because of disease and determining the suitability of a patient's eye for the grafting operation are among the problems the Eye-Bank is studying in efforts to extend this sight-preserving procedure.

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MEDICINE

Gland Role in Mental Ills

Adrenal hormone discovery may lead to more successful treatment of mental sickness if further research reveals the relation between glands and emotional stress.

➤ A GLAND DISCOVERY that gives a new lead to the mental disease problem is announced by Dr. Hudson Hoagland, Dr. Gregory Pincus and Fred Elmadjian of the Worcester Foundation for Experimental Biology.

In the mentally sick, the Worcester group finds, the adrenal glands respond to stress in a way strikingly different from their response to stress in normal persons. The adrenals are small organs that sit like cocked hats one atop each kidney. They produce two hormones, epinephrine, also called adrenalin, and cortin. The cortin-producing part of the gland, which is not under nervous control, is the part that responds differently under stress.

A count of certain white blood cells called lymphocytes gives one measure of the activity of the cortin-producing part of the adrenals. In normal persons, operation of a pursuitmeter under simulated high altitude flying conditions may drop the lymphocytes 40%. A rise of like amount on the average occurs in mentally sick patients when operating the pursuitmeter under the same conditions. The amount of stress this operation involves has been called by Army pilots as tiring as close formation flying under poor weather conditions.

The mentally sick are persons who have broken psychologically under the stresses of life. It now appears that the functioning of certain glands in the mentally sick is inadequate to meet stress situations. Whether the gland failure is responsible for the mental sickness has not yet been determined, but scientists have long been searching for such a physiological failure to explain the psychological break.

More successful treatment of mental sickness might follow the important lead which the Worcester discovery gives. At present the scientists are trying to localize the mechanism responsible for the gland failure. It may be in any of three places: 1. the outer part, or cortex of the adrenal gland which produces cortin; 2. the pituitary gland in the head which normally stimulates the adrenal glands to produce cortin; 3. the hypothalamus in the base of the brain which controls the pituitary gland. Since the hypothalamus is intimately related to emotional life, a defect in it could have widespread repercussions in both the psychology and physiology of the patient.

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GENERAL SCIENCE

Only Two U. S. Delegates To UNESCO Are Scientists

➤ ONLY TWO of the 45 U. S. delegates and counsellors at the United Nations Educational, Scientific and Cultural Organization general conference in Paris are representatives of the natural sciences. They are Dr. Arthur H. Compton, chancellor of Washington University, St. Louis, and Dr. W. Albert Noyes, president-elect of the American Chemical Society.

This small proportion compares unfavorably with the proportion of scientists in other delegations. France, for example, has seven scientists among the 35 members of her delegation, and Australia has three out of 10.

In fact, it may be said that among the more important countries represented, the U. S. has the lowest representation of science of any delegation.

In view of the great weight which the U. S. delegation's views carry in the councils of UNESCO, it is feared that this may adversely affect some of the scientific projects now before the conference.

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INDUSTRY

Batteries Are Scarce Because of Lead Shortage

➤ THERE IS A HARD winter ahead for automobile owners whose cars need new batteries. The shortage of batteries is due to a shortage of lead, and little relief is expected in the next few months.

The United States is one of the world's greater lead-producing nations but even in the lush production years two decades ago did not mine enough to meet all domestic needs. It imported about one-eighth of the total consumed, which included recovered lead as well as metal just from the ground.

Since before 1930, American production has been decreasing more or less steadily. The average annual lead refined from ore during the 1925-29 period was approximately 660,500 tons. In 1944, less than 395,000 tons were produced. For 1946 the production is estimated at approximately 335,000 tons.

America each year uses great quantities of reprocessed old lead. This secondary recovery in the 1925-29 period was 280,000 tons a year. Much larger recovery prevailed during the war years, but it had dropped to 332,000 tons in 1944. Recovery this year is predicted as much less, but figures are as yet unavailable.

The decrease in lead production in the United States is due to depletion of ore deposits in certain districts, and to manpower shortage during the war and since. Strikes have been a factor. Shortages abroad are due to lack of equipment and manpower resulting from war devastation. Little lead may be expected for some time from Germany, Yugoslavia and Burma, and even lead imports from Mexico will be curtailed.

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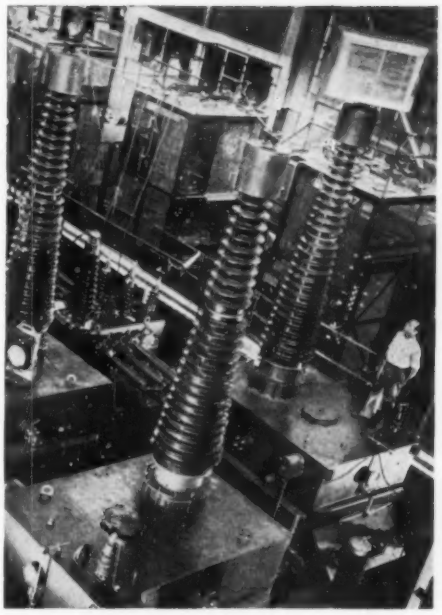

TRANSFORMERS—Built to step-up electric current to as much as 500,000 volts these transformers will serve the world's most powerful transmission line. Westinghouse Electric Corp. photograph.

CHEMISTRY

Mixture Detects Presence of Traces of Carbon Monoxide

➤ DANGER from carbon monoxide poisoning can be avoided by use of a simple, relatively inexpensive method developed by the National Bureau of Standards that will indicate by color as little as one part of the dangerous gas in 500,000,000 parts of air.

It was developed for determining the amount of carbon monoxide within aircraft, but can be used to equal advantage in buses, automobiles, garages, furnace rooms, and other places where this gas may lodge from incomplete combustion in engines or stoves.

The color indicator used in this new carbon monoxide detector is a yellow silica gel impregnated with a complex silico-molybdate compound and catalyzed by means of palladium sulfate. This mixture is placed in a five-inch glass tube the size of a lead pencil, and air to be tested forced through. The yellow indicator turns green if carbon monoxide is present, the degree of green indicating the amount of the poisonous gas.

In use the sealed ends of the glass tube are broken open and one end of the tube is inserted in an ordinary two-ounce rubber aspirator bulb equipped with a special control valve. The bulb is squeezed once, then the color of the gel is compared with a set of standard color chips. A test can be made by an untrained person in about one minute.

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ARCHAEOLOGY

Western Planned Cities Date Far Back in History

➤ PLANNED CITIES, such as Washington, are an old development in the Western Hemisphere, archaeologists have discovered. Peru had carefully laid-out cities with geometrically patterned streets before the Incas, who were conquered by the Spaniards.

Scientists of the Institute of Andean Research this summer mapped 300 sites of early peoples in the Viru Valley of northern Peru, revealing portions of a story of 3,000 years of human culture in the small fertile valley.

Dr. Gordon R. Willey of the Smithsonian Institution, who specialized in the settlement patterns of the early Peruvian groups, says that the 300 sites studied so far are probably about one-fourth of those in the valley.

Human beings have lived in the Viru valley from about 1,000 B. C. to the present, with eight distinct cultural periods up to the time of the Spanish conquest.

The planned cities, which did not appear in Europe until well into the metal ages, have been unearthed in northern Peru among the remains of a culture before the Incas.

In these early cities, there were places assigned for temples, other public buildings, storehouses and dwellings. Largest of the cities was Chanchan, by far the largest city in the New World before white men came. Dr. Willey believes these planned cities were developed by a culture in which everybody knew his place and lived according to a prescribed pattern.

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INVENTION

Light Beams Help to See Down Inside Beer-Cans

➤ INSPECTING the insides of bottle-necked beer-cans or other opaque containers with small openings seems a baffling job. Yet it must be done before filling, to detect loss-causing faults. I. W. England of Passaic, N. J., and W. F. Punte of Syracuse, N. Y., have solved it by projecting light beams obliquely into the neck, while immediately above these lamps is a lens train that throws an image of the can's interior onto a screen which the inspector watches. Automatic mechanism feeds the cans into position, with a momentary pause to let each be viewed.

Patent 2,411,991, issued on this invention, has been assigned to the Continental Can Company.

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CHEMISTRY

Formaldehyde Is Made From Air and Natural Gas

➤ AN IMPROVEMENT in the process of manufacturing formaldehyde, important as a disinfectant and as an ingredient of plastics, out of air and natural gas, has been made by Dr. Thomas K. Sherwood of Wellesley, Mass. By raising the working temperature, he completes the process in a small fraction of the time formerly required. The formaldehyde vapor is then condensed by contact with a cool formaldehyde solution. Patent 2,412,014, covering this process, is assigned to Godfrey L. Cabot, Inc., of Boston.

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IN SCIENCE

ARCHITECTURE

Good Adobe Keeps Houses From Becoming Mud Pies

➤ DO YOU THINK you might beat the housing shortage by throwing up an adobe home in the style of California and the Southwest?

You'd better think twice or you might find yourself with a mound of mud after a few good rains.

This is the synthesis of advice on adobe construction given in a bulletin of the University of California College of Agriculture.

The right kind of adobe will make a good house, the bulletin says. But tests should be made to determine the characteristics of the soil.

Adobe houses can be made of bricks, rammed earth, or poured adobe or mud concrete. Costs are about the same as for a wooden home of the same size, though this can be cut by the builder using his own labor and eliminating decorations.

Science News Letter, December 14, 1946

ORDNANCE

Atom Bomb Does Not Harm Weapons of Many Types

➤ ATOM-BOMB blasts will not injure weapons of many types, ranging from tommy-guns to tanks, it was demonstrated by the tests at Bikini. Final evaluation of the effects of the explosions on Army materiel exposed on the decks of some of the target ships is given by Lt. Col. S. F. Musselman in *Army Ordnance* (Nov.-Dec.).

Many of these weapons, which showed no permanent effects from either concussion or radioactivity, have already been returned to arsenals, whence they will be issued to troops for regular use. Most damage from concussion was sustained by vehicles such as jeeps and tanks, which were securely bolted to the decks and hence could not "roll with the punch".

Damage from the underwater explosion was mostly salt-water corrosion, not essentially different from that shown by metal after any ordinary kind of salt-spray exposure.

Science News Letter, December 14, 1946

E FIELDS

PHYSICS

Tiny Radio Antennas Aid Navy Communications

➤ TOM THUMB radio antennas are being constructed and tested in laboratories at the University of California in an effort to improve naval communications.

Tiny, scale models of transmitters of all different shapes are "given the works" in the electronics research laboratory. Promising models will be built full size and given full-dress tryouts aboard naval vessels.

Thomas McFarland, University engineer in charge of the project, says that naval communications have been seriously handicapped by the presence aboard vessels of large numbers of transmitters which interfere with one another; and by construction characteristics of naval architecture.

For example, some transmitters can send only in one direction, or in a seriously restricted arc from the ship. Thus a ship might have to travel in a certain direction for a specific antenna to be of any use.

Mr. McFarland indicated that research may develop transmitters which will overcome some of these difficulties, and that changes in ship design might be needed to solve the problem finally.

Science News Letter, December 14, 1946

ENGINEERING

Plenty of Liquid Fuels To Come From Coal

➤ THERE WILL BE plenty of gaseous and liquid fuels available in America for a thousand years or more, the American Society of Mechanical Engineers was told by Arno C. Fieldner, chief of fuels and explosives of the U. S. Bureau of Mines.

These fuels may not be petroleum products, however; they will be derived from coal and lignite, of which there are abundant reserves. Production from these sources will increase as the reserves of petroleum and natural gas approach exhaustion.

Coal and lignite can be converted into gaseous and liquid fuel, he said, and have been so converted for many years. Processes and equipment for this purpose have been developed, and the costs are known. In recent years, in Germany in particular, processes have been put into commercial operation for the manufacture of liquid fuel from coal and from lignite.

Mr. Fieldner estimated the known fuel reserves of the United States at an energy equivalent to 2,600,000,000,000 tons of bituminous coal. Approximately 55% of this solid fuel is high-volatile bituminous coal, 23% subbituminous coal, 19% lignite, 2.5% low-volatile bituminous, and 0.5% anthracite.

A declining supply of petroleum can be supplemented also by alcohol from the fermentation of vegetable matter, conversion of natural gas by the gas-synthesis process, and the distillation of oil shale.

The cost of fuels from coal and lignite will be greater than the present cost of petroleum and natural gas, he said, but future developments in the more efficient utilization of fuels should go far in offsetting the cost of conversion.

Science News Letter, December 14, 1946

AERONAUTICS

Railway Cars May Replace Landing Gears on Planes

➤ FLAT RAILWAY cars on tracks on airfields are suggested to replace the present built-in-landing gears on planes.

A powered railway car operating on a track several miles long could be used for take-offs also, Lewis A. Rodert, of the National Advisory Committee for Aeronautics, told the Society of Automotive Engineers in Chicago.

Explaining that the attainment of higher air travel speeds calls for eliminating such current handicaps as conflicts in design, equipment, and technical requirements for flying, taking off, and landing, he directed attention to the possibility of eliminating the landing gear of long-distance planes and of substituting flat fuselage bottoms suitable not only for landing on moving railway cars, but for protecting passengers in case of forced emergency landing.

Launching would be accomplished by accelerating the car, the plane being released when climbing speed is reached. In landings, the plane would follow radio range beacons and glide path control equipment to land on the fast moving car which would be brought gradually to a standstill after the plane was aboard.

Science News Letter, December 14, 1946

MEDICINE

Baby Blood-Typing Is Best Identification

➤ COMPLETE TYPING of new-born babies' blood, with 360 blood varieties available for identification, is advocated as a replacement of the foot-printing now common practice to prevent tragic mix-ups in maternity hospitals. This idea is offered in the *Journal of the American Medical Association* (Dec. 7) by Dr. Malcolm A. Hyman of the Jewish Hospital of Brooklyn.

The 360 different identifiable kinds of human blood are made possible by a combination of the various blood types, the agglutinogen P (plus and minus), and ten Rh-Hr types.

Dr. Hyman advocates collecting a little blood from the new-born infant's umbilical cord, putting it in a corked tube, and attaching this to the mother before the child leaves her side for its first bassinet. If any doubt of the baby's identity should subsequently arise, a new sample could be drawn and compared with the original one.

Dr. Hyman points out that babies' footprints, as made at present, usually become smudged aand unrecognizable in a relatively short time. In any event, by the time the child is a month old the footprint has changed completely and is useless for identification purposes. The chemical pattern of the blood, on the other hand, is unchanging.

Science News Letter, December 14, 1946

PHARMACOLOGY

Pharmacists Will Take Sting Out of Iodine

➤ PHARMACISTS are going to take the sting out of tincture of iodine, a famous disinfectant for cuts for more than a century.

The new edition of the Pharmacopoeia of the United States of America, which will become official April 1, 1947, has dropped the familiar 7% tincture of iodine in favor of a 2% mild tincture. Just as efficient as an antiseptic and germicide, the milder tincture has the advantage of not retarding healing by destroying tissue, a frequent fault of the stronger remedy.

The Committee of Revision of the Pharmacopoeia declares, "Every druggist in the country should be familiar with this change." You will agree if you recall the sting of the old iodine disinfectant.

Science News Letter, December 14, 1946

ENGINEERING

Less Friction in World

Bearings speed almost all equipment that rolls and floats. Smallest bearings used are part of high-powered microscopes, largest are in giant presses.

See Front Cover

By MARTHA G. MORROW

➤ THERE is much less friction in the world because little and big balls and rollers are bearing some of the burdens in our vast array of machines—from lawn mowers to locomotives.

The smallest ball bearing actually used today is one that is part of high-precision electric gauges and high-powered microscopes. It is small enough to get through the eye of a needle, and not an oversize needle at that.

One of the largest roller bearings is used in giant presses that roll steel into finished sheets. This bearing is five feet in diameter.

Millions upon millions of ball and roller bearings are twirling around, reducing to a minimum useless friction in bicycles, dial telephones, vacuum cleaners and washing machines.

Use in Automobiles

Every automobile incorporates 25 to 30 anti-friction bearings. About 2,500 precision-smooth bearings are used in commercial air lines.

One of the strangest applications is in a building that has roller-bearing foundations. The idea is to allow the building to stand still when an earthquake moves the earth beneath it. The bearings take the force of the tremor from any given direction.

Some scientists want to split hairs. A knife that cuts specimens of human or animal tissue into slices 500 times thinner than a human hair whirls around on ball bearings.

Microscopic balls only 1/64th of an inch in diameter may soon replace jewels in watch bearings. Of a special chrome alloy, they do not crack as easily as the conventional quartz or gem jewels.

Ball and roller bearings reduce friction to a minimum in practically every piece of man-made equipment that rolls, floats or flies. If it contains turning parts, anti-friction bearings are probably used.

But steel balls or rollers alone do not make a bearing. Merely inserting steel balls, for instance, between a wheel and its shaft would not solve the friction problem.

The balls are held in place by two concentric steel rings. They run in grooves or "raceways" cut in the rings. A retainer or separator is usually inserted to keep them from rubbing against each other.

In a roller bearing, essentially the same set of parts is used, except that rollers are employed instead of balls.

In modern mechanical equipment, bearings may have to carry loads of three general types. The load may be at right angles to the shaft, it may be parallel to the shaft, or it may be a combination of both, called an angular load.

The earliest modern ball bearings, used in all bicycles and automobiles, were of the angular type. In these the inner ring was placed on the axle and the outer ring on the wheel hubs. Modern anti-friction bearings are designed to operate under various combinations of these loads. They must meet different space limitations and fulfill literally thousands of variable requirements. That is why so many standard varieties are needed.

Today more than 30,000 different sizes, types and specifications of anti-friction bearings are serving millions of machines. But despite the wide range, all bearings are precisioned to a tolerance of one-thousandth to one-millionth of an inch, depending upon the size.

During the last two years of the war, more than 30,000,000 complete ball and roller bearings were made each month for military equipment of the United States alone. Today 72% of the total output of the industry is used to give us smoother rides in trains and trucks, airplanes and buses.

Made From Steel

Balls for bearings are made from high-quality steel wire. For all sizes up to three-quarters of an inch in diameter, slugs of wire are chopped off and placed between the cup-shaped dies. These bang the steel slugs into a rough ball shape.

A ring of extra metal, left where the two dies meet, is removed in oil. The excess metal is not ground off, but is literally rolled off.

If the balls are ⅜ inch in diameter, or larger, they are hardened to relieve strains caused by upsetting the grain structure in heating. After heating in an

LUBRICATION—Eliminating hot-boxes, roller bearings installed on high-speed locomotives and trains are lubricated only when the equipment is brought into the shop for general inspection. Ball and Roller Bearing Information Center photographs.

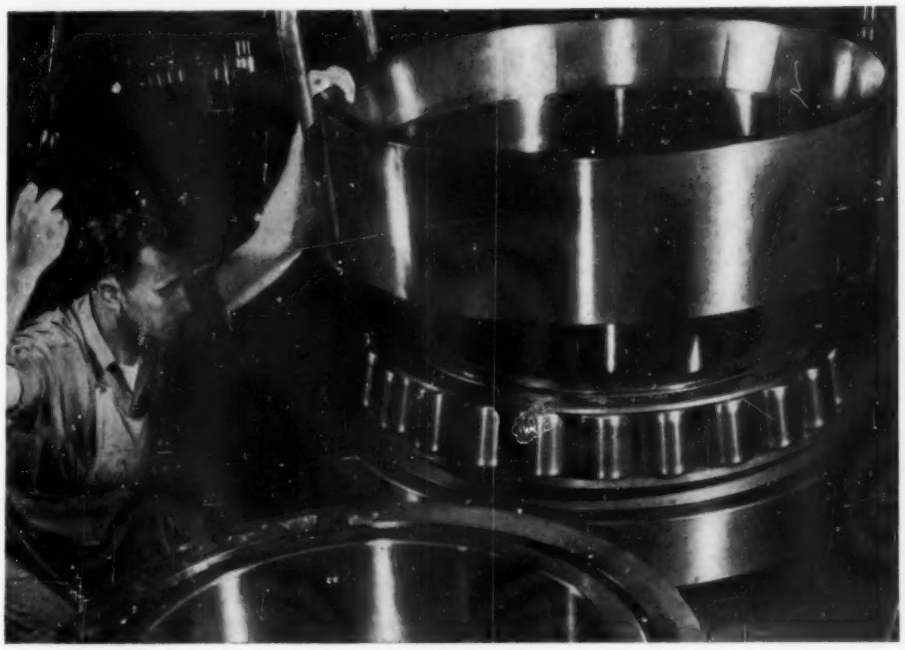
electric furnace, the still-hot balls are dipped in oil or water to cool.

The steel spheres are reground, heat-treated and given a final precision grinding. They then may differ in size by only a small fraction of an inch and are glass-smooth.

To make them perfectly uniform in size, the balls are tumbled in barrels containing lime and water. The lapping action of the balls rubbing against each other actually cuts their diameter down a minute fraction and polishes them until they shine like mirrors. For a super-finish, the balls are tumbled against pieces of kid and chamois leather.

Trained inspectors use high-powered gauges and other special apparatus to detect any imperfections such as cuts, cracks, dents, out-of-rounds and soft spots.

The balls must be graded carefully for size. If they vary more than one ten-thousandth of an inch in precision smoothness, some might have to bear an unequal proportion of the load.



CROWNING IT—Outer ring is being put on enormous tapered bearing.

Perfect Fit

Inner and outer rings and retainers are handled with equal exactness. All parts must fit perfectly with nothing to cause friction as the balls silently and smoothly travel in the greased raceways.

Some bearings have a single row of mirror-like balls. Ball bearings of this type are used in drills, presses, on rotating shafts of automobile engines and lawnmowers.

Sometimes a double row of ball bearings are used. These are particularly useful where greater accuracy of shaft location is required, as on grinder spindles. Special non-metallic retainers reduce friction so the shafts can make 30,000 revolutions a minute.

The movable parts of a bearing are carefully greased so they will run smoother and wear longer. Occasionally the balls are protected on the outside by metal strips to seal in the grease and keep out abrasive dirt and dust.

Many rollers for bearings are uniform in shape. Known as straight roller bearings, these are used where heavy loads are required.

The rollers in other bearings are thicker at one end than the other. A tapered bearing incorporating such rolls is used to carry thrust, radial and combination loads.

Where the shaft of the machine acts as the inner ring, needle bearings are used. Slim rollers, pointed at both ends, are kept in place by a retaining lip on the outer ring or shell.

Bearings are made from several types of steel. A low carbon steel is used for the ordinary bearings, such as those in roller skates, bicycles, casters and pedals. Special chrome steel alloys make the finest super-precisioned ball bearings.

Metal alloys such as stainless steel are used for non-corrosive metal balls when the bearings will be exposed to acid fumes, salt water or food products.

Anti-friction bearings are inspected and tested by devices of incredible precision. One sensitive electric gauge must be shielded from the sun, or its metal parts might expand enough to permit a

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slight error. It is this type of gauge that measures balls and rollers to tolerances of millionths of an inch.

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The picture on the cover of this SCIENCE NEWS LETTER shows workers giving roller bearings a final going over as they ready them for streamlined passenger equipment.

Gloves, masks and gowns, familiar to operating rooms, are standard equipment in making the extremely small bearings. Hypodermic syringes are used when a single drop of oil must be placed on the miniature ball bearings slightly larger than the head of a pin.

The rooms are air-conditioned to filter the dust from the air and keep the temperature and humidity constant. Air-jets like those in a "fun house" remove dust from workers' clothes before they enter the assembly rooms.

To understand how bearings act as

(*Turn to page 383*)

BOTANY

NATURE RAMBLINGS

by Frank Thone

Christmas Conservation

➤ CHRISTMAS wreaths and garlands are on the market again, their glossy green leaves and bright red berries tempting even the thriftiest to open his purse. Yet it is well to eye before you buy, and to refuse certain items entirely because they violate the spirit of the feast by doing real harm to God's gardens, where wild things grow.

No thoughtful Christmas shopper, for example, will ever buy anything made of ground pine, the prickly, fine-leaved plant that is often the only ground cover in great reaches of thin-soiled woods. Gatherers of ground pine rip it up heedless of later consequences, leaving the trees' precarious roothold open to rapid erosion. Ground pine just doesn't mean Christmas to people who know.

Similarly, when buying holly you should insist on English holly. It is grown for the market in this country, and by purchasing it you help the growers to make an honest living. Native American holly, on the other hand, is always obtained by raiding the woods where it grows. Usually the raiders work in haste, for theirs is an illicit trade, and they break and rip the branches disgracefully. You can tell English holly readily by its bigger, redder berries, by its pricklier, darker green leaves—and by its higher price. But it's worth the difference.

It is all right, however, to buy the synthetic Christmas "greens" made by combining the evergreen leaves of mountain laurel with twigs of the red-fruited winterberry, gathered usually in swampy places. This plant is a first cousin to holly, but sheds its leaves in autumn. Both mountain laurel and winterberry are so abundant in the regions where they grow that once-a-year cropping seems unlikely to do any material harm.

Mistletoe, also, is something you can buy freely without any qualms of your conservationist conscience. In fact, the more mistletoe is harvested the better it is for the woods. For mistletoe, despite its romantic connotations, is a harmful parasite that robs trees of their sap, and the more of it is removed the better off the trees will be.

Science News Letter, December 14, 1946

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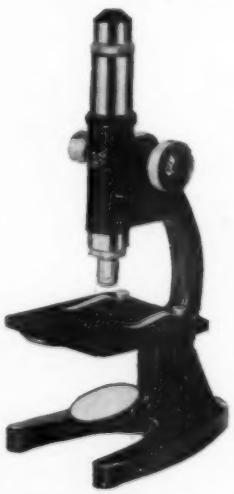

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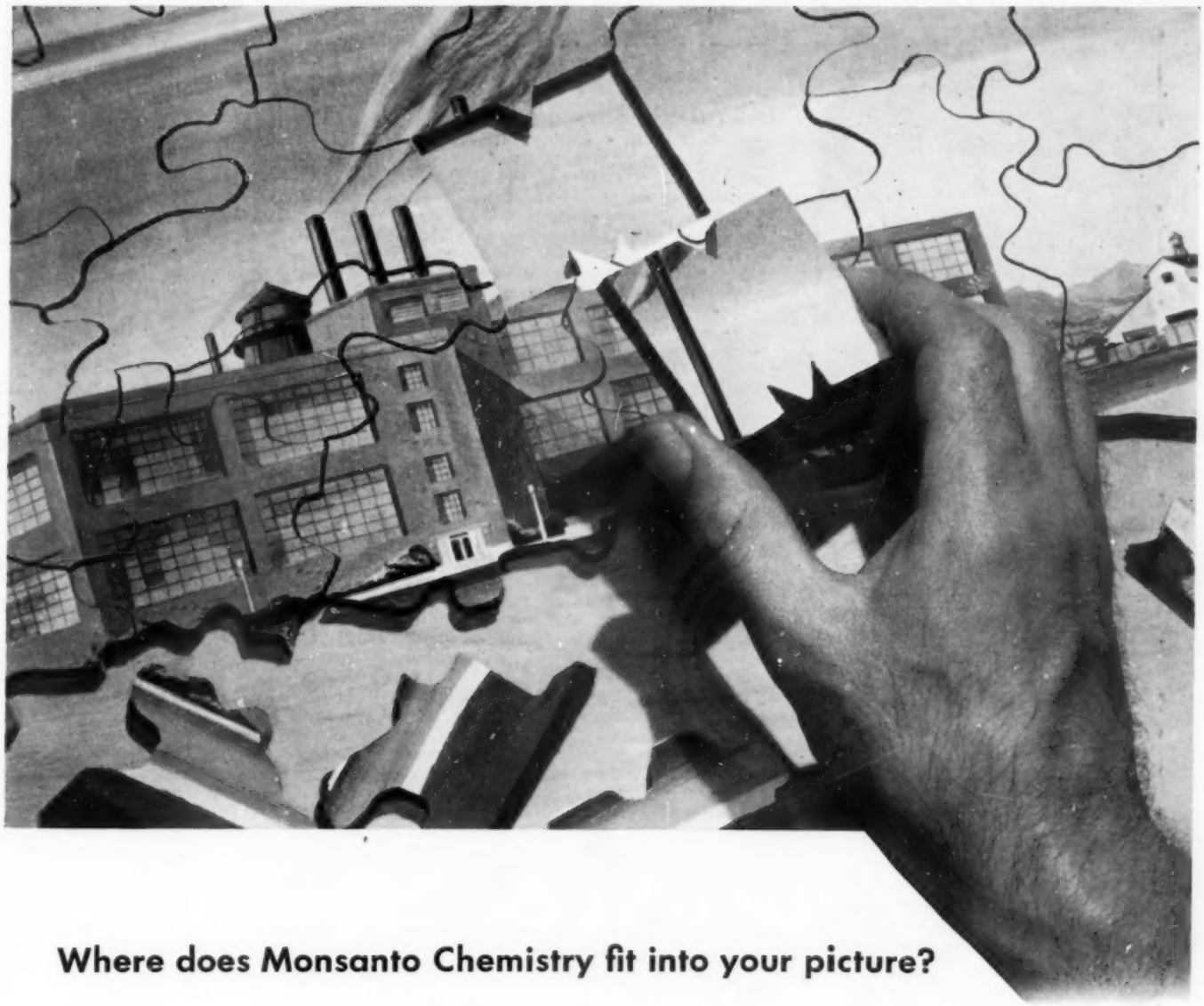

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ADOLESCENT STERILITY—M. F. Ashley Montagu—*Charles C. Thomas,* 148 p., tables, $3.50. A study in the comparative physiology of the infecundity of the adolescent organism in mammals and man.

CARTELS IN ACTION—George W. Stocking and Myron W. Watkins—*Twentieth Century Fund,* 533 p., $4. A "casebook" on international cartels, giving origins and operations of cartel arrangements in sugar, rubber, nitrogen, steel, aluminum, magnesium, incandescent electric lamps and chemicals, with factual answers to many critical questions about controls in economic affairs.

EAMON DE VALERA—M. J. MacManus—*Ziff-Davis,* 281 p., $3. A biography of the man who was the storm center of Ireland's fight for independence from the British Empire, as well as a dramatic record of that revolution.

FIRE FIGHTING ON FARMS—A. T. Holman—*U. S. Department of Agriculture,* Miscellaneous Publication No. 612, 54 p., illus., paper, 15 cents. Instructions to farmers and rural dwellers on types of fires, fire fighting equipment and chemicals, with instructions about how to build or assemble equipment for local use, and general rules about fire fighting.

FOODS: THEIR VALUE AND MANAGEMENT—Henry C. Sherman—*Columbia Univ. Press,* 221 p., $3.25. A companion book to The Science of Nutrition by the same author. Addressed to all who are interested in individual and family health and efficiency. Chapters are devoted to each of ten food groups, each group being considered from the standpoint of its nutritional value and its purchase value.

GALVANIZING HANDBOOK—J. R. Daesen—*Reinhold,* 166 p., illus., $5.25. This book presents graphically the basic principles involved in the business of zinc-coating iron and steel to prevent rusting, setting forth new methods involved. Its many photographs demonstrate the nature and cause of many defects encountered in this varied field.

GARDEN PLANS FOR LOW COST HOMES—*National Garden Institute,* 18 p., illus., paper, 10 cents. Another service to victory gardeners who are interested in landscaping old or new homesites, large or small. The layouts have been designed by ten outstanding landscape designers.

HEREDITY, RACE, AND SOCIETY—L. C. Dunn and Th. Dobzhansky—*Penguin,* 115 p., paper, 25 cents. The facts about heredity and its application to man and mammals, told in clear, simple thoroughly scientific language.

INTRODUCTION TO THE CHEMISTRY OF SILICONES—Eugene G. Rochow—*Wiley,* 137 p., $2.75. The chemist, engineer and industrial designer are given a comprehensive survey of the present knowledge in the silicon field. The non-silicate compounds of silicon are discussed, as well as those silicon polymers which have achieved commercial importance, how they are prepared, their chemical and physical properties, and their possible uses.

LATITUDE 40° PLANISPHERE For Finding and Identifying Constellations in the Northern Hemisphere—Wm. H. Barton, Jr.—*Addison-Wesley Press,* $1. A star map showing the Northern Hemisphere for use of astronomers, with charts and other vital data.

THE MONEY VALUE OF A MAN—Louis I. Dublin and Alfred J. Lotka—*Ronald Press,* 214 p., tables, $6. This book is concerned with man as a wage-earner and supporter of himself and his family during the productive years of his life and protection for his family after his earning ability has ceased. The discussion is strictly practical, with no consideration of sentimental values.

PETROLEUM PRODUCTION, The Optimum Rate of Production—Vol. II—Park J. Jones—*Reinhold,* 293 p., diagr., $4.50. A technical work on oil production.

PLASTIC CRAFT—Ernest Dewick and John H. Cooper—*Macmillan,* 184 p., illus., $5. Complete how-to-do-it instructions for making useful and decorative articles from plastics in the home or school workshop, with opportunities for the use of any tool, and for workers with many degrees of skill. There is useful information on types of suitable plastics and where they may be obtained.

READINGS IN LATIN AMERICAN CIVILIZATION—A. Curtis Wilgus, ed.—*Barnes & Noble,* 430 p., paper, $1.50. A compilation of documents for use by students and teachers in the field of Hispanic America. Because of the wide range of the subject matter of the readings, the book can be used in courses of geography, Spanish, and international relations.

REFERENCE DATA FOR RADIO ENGINEERS—*Federal Telephone and Radio Corporation,* second edition, 322 p. and index, illus., $2. An aid in the fields of research, development, production, operation and education in the radio industry. Chapters on transformers and room acoustics have been added, and the data on television, radar and cathode-ray tubes have been expanded, together with much other new technical information.

RUSSIA AND AMERICA: PACIFIC NEIGHBORS—Foster Rhea Dulles—I. P. R. Pamphlets No. 22—*American Council, Institute of Pacific Relations,* 63 p., illus., paper, 25 cents. A resume of the geographical, diplomatic, economic and political relations of the Soviet Union and the United States and their effects upon the world situation.

SCIENCE REMAKES OUR WORLD—James Stokley—*Ives Washburn,* 318 p., illus., $3.50. A revised edition book, written in

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YOUNG PEOPLE'S BOOK OF ATOMIC ENERGY—Robert D. Potter—*Robert M. McBride*, 171 p., illus., $2.50. Written with simplicity and clarity for the young reader from 12 to 16.

Science News Letter, December 14, 1946

From Page 380

steel cushions for moving parts, place a heavy book on a table and try to push it with a long, thin ruler. Now put two round pencils of about the same size underneath the book and push at right angles to the parallel pencils.

When the book lay directly on the table, there was friction—resistance to motion of two surfaces in contact—at every point of contact. When the pencils were placed beneath the book, a rolling motion was substituted for a sliding motion and the book moved much more easily. Rollers and balls move more freely because only a tiny part of their surface touches the surface on which they move.

The wheel was the first important victory over friction. But wheels were poorly built at first and remained so even to comparatively modern times. The first wheel was probably a cross-section of a tree trunk. A hole in the center, perhaps burned through, held a crude type of axle.

Simple wheels, however, could not turn fast or carry heavy loads, because each rested directly on the axles on which they turned. Sliding friction soon wore away both wheel and shaft. The wheel wobbled, turned loosely, and finally fell off.

Man fought friction in early days by greasing axles and shafts with animal fat. Such lubrication helped somewhat, but heat built up by turning axles soon burned up the grease. The fat, settling toward the bottom of the shafts when at rest, was soon squeezed out. Hubs had to be greased frequently.

Until the beginning of the twentieth century most wheels worked on the sliding principle. Although the wheels turned, the axle and wheel still slid in relation to each other. Power began to be used efficiently only when wheels were rested on an assembly of balls and rollers—when the bearings between the wheel and the axle were themselves free to roll.

Science News Letter, December 14, 1946

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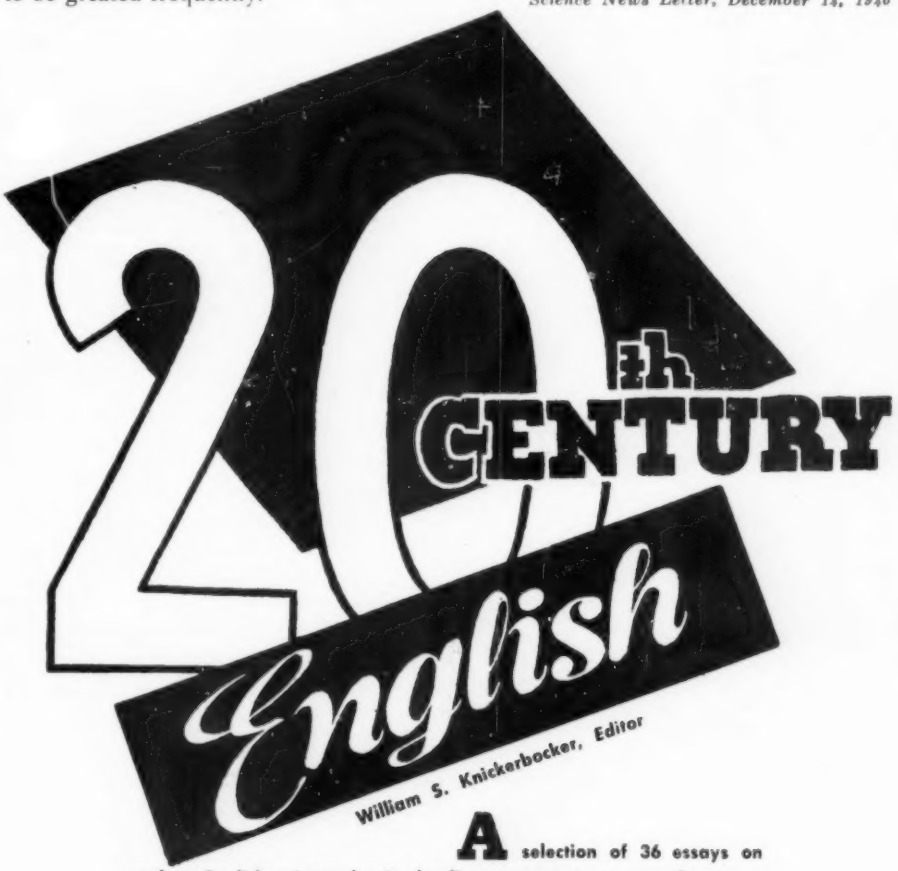

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